

# THE LANDSLIDE SOUTH OF IMMENSTADT/ALLGÄU

## A COMBINED LANDSLIDE CAUSING DANGERS TO THE TOWN AND INFRASTRUCTURE FACILITIES

Karl Mayer<sup>1</sup>, Günther Bunza<sup>2</sup>

In the night between March, 14<sup>th</sup> and 15<sup>th</sup> 2006 a landslide at the southern outskirts of Immenstadt started to move. The landslide is situated at the eastern slope of the Immenstädter Horn mountain (1.166 m a.s.l.). Due to the fact, that the landslide was very close to the town it was observed since a very early stage, so that a detailed documentation of further developments was possible.

### GEOLOGICAL SITUATION

From the geological point of view the whole area south of the town Immenstadt is situated in the folded Molasse, the most northern tectonic unit of the Bavarian Alps. In the west of the Steigbach and so in the landslide area, Steigbachschichten can be found in the lower slope area. The upper slope area is made up of the Kojenschichten. A morphological terrace at 850 m a.s.l. marks the boundary between these two stratigraphic units. The Steigbachschichten as well as the Kojenschichten are characterized by alternating layers of conglomerates, sandstones and marlstones.

### DEVELOPMENT OF THE LANDSLIDE

The landslide is located in an area, which was already known as a dormant landslide area. Between the Steigbach and the peak of the Immenstädter Horn old rock fall material and creeping areas can be found between 760 m a.s.l. and 1090 m a.s.l..

In August 2005 heavy rainfalls caused first active movements at the crown of the landslide at 950 m a.s.l.. During the following strong winter no greater movements were recognized until the 14<sup>th</sup> March 2006. Between March, 14<sup>th</sup> and 17<sup>th</sup> fast movements started, so that an area of about 6000 m<sup>2</sup> between 860 m a.s.l. and 950 m a.s.l. was affected by the landslide.

Until March, 23<sup>rd</sup> the landslide area took about 10.000 m<sup>2</sup>. The whole landslide material was accumulated in a morphological terrace at 860 m a.s.l.

The weight of the landslide masses in this morphological terrace caused a collapse of the lower slope area between 850 m a.s.l. and the Steigbach so that a secondary landslide developed. Until Oktober 2006 the primary landslide took about 25.000 m<sup>2</sup>. The area affected by the secondary landslide is about 21.000 m<sup>2</sup>. The estimated volume of the whole landslide is about 400.000 – 500.000 m<sup>3</sup>.

---

1 Karl Mayer Dipl.-Geol., Bayerisches Landesamt für Umwelt, Geologischer Dienst, Ref. Angewandte Geologie Süd, Bürgermeister-Ulrich-Str. 160, 86179 Augsburg, Deutschland (Tel.: +49-89-9214-2679; Fax: +49-89-9214-1435; email: karl.mayer@lfu.bayern.de)

2 Assoc. Prof. Dr. Günther Bunza Dipl.-Geol., Bayerisches Landesamt für Umwelt, Ref. Hochwasserschutz und alpine Naturgefahren, Bürgermeister-Ulrich-Str. 160, 86179 Augsburg, Deutschland (Tel.: +49-89-9214-1027; Fax: +49-89-9214-1435; email: guenther.bunza@lfu.bayern.de)

**Fig. 1:** View from the north to the landslide area. The white triangle shows the position of the morphological terrace which divides the primary and the secondary landslide area. The white square indicates the position of the water supply of Immenstadt



The landslide area can be divided in two parts. The upper part above the morphological terrace is the primary landslide; the lower part is the secondary landslide. From March 2006 until January 2007 the activity has not ceased.

Detailed investigations like seismic refraction surveying, engineering geological and morphological mappings and

geotechnical investigations gave a good overview to estimate the future development of the landslide.

## **DANGERS**

The landslide causes three main dangers:

- damming the Steigbach
- destroying the roads to the Steigbach valley
- destroying the water supply of Immenstadt

## **PRELIMINARY MEASURES OF RISK MITIGATION**

Sediment inputs by slides and mud-rock-flows in consequence of the continuous movements into the Steigbach are possible at any time. Such inputs have destroyed a check dam already at the beginning of the landslide. Therefore peak flows with different bed load transport rates could arise especially during high water discharges. If failures and/or blockages would happen the settlement area of Immenstadt would be endangered directly. Also the only access to the Steigbach valley, with several houses and important pasture and forest interests, is frequently cut by the landslide and the main water supply of Immenstadt is directly endangered. Hence protective measures are realized at present: a check dam is built at the toe of the landslide masses. In connection with these measures drainages by bedded rock fills and longitudinal constructions by ripraps are made. Beyond that an open debris retention dam is built in the lower course. A drain channel was built to protect the water supply. Geodetic observations in the landslide area and in the area around the landslide are carried out (frequently) to detect a further extension of the landslide area in time.

**Keywords:** landslide, risk mitigation, debris flow